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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
H04Q 7/38, H04L 12/56

A1

(11) International Publication Number: WO 00/16580

(43) International Publication Date: 23 March 2000 (23.03.00)

(21) International Application Number: PCT/FI99/00759

(22) International Filing Date: 15 September 1999 (15.09.99)

(30) Priority Data:
982001 16 September 1998 (16.09.98) FI

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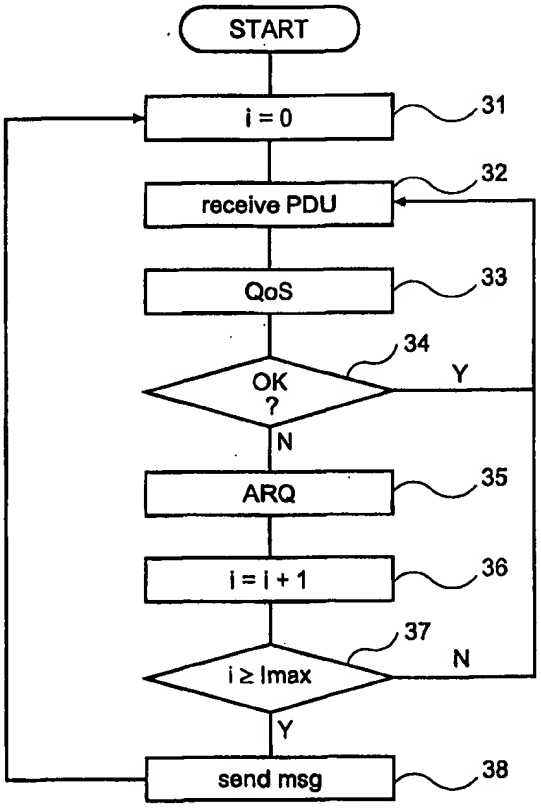
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A METHOD AND SYSTEM FOR MANAGING A BEARER PROPERTIES AT RETRANSMISSION

(57) Abstract

A method for transferring data, in which method data units are transferred between a telecommunication network and mobile stations; the received data units are checked; data units found to be defect are retransmitted, the number of retransmissions is monitored; the number of retransmissions is compared with a predetermined threshold value; and, as a response to exceeding the threshold value, proceedings related to the changes of properties of the bearer are initiated.



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A METHOD AND SYSTEM FOR MANAGING A BEARER PROPERTIES AT RETRANSMISSION

The present invention relates to data transfer systems and in particular a data transfer system comprising means for transferring data units; and means for retransmitting units which have been found containing errors.

Due to the limited radio resources the sufficiency of available capacity has always to be accounted for in data transfer over air interface. The data to be transferred over radio path is processed and compressed in a number of ways. Along with new applications the need of transferring larger quantities of data is continuously growing and this has resulted in solutions in which the available resource is adapted to the actual need of transfer and is reserved only for the time required.

In the popular digital mobile communications system GSM (Global System for Mobile Communications) the normal circuit switched data transfer rate is 9.6kbps. In order to increase the data transfer rate, ETSI (European Telecommunication Standards Institute) has developed a number of enhancements, jointly called as GSM Phase 2+. One of the GSM Phase 2+ enhancements is known as HSCSD (High Speed Circuit Switched Data, described in ETSI standards 02.34 and 03.34), in which the circuit switched data transfer rate can be increased by reserving a double or multiple resource compared with the resource normally reserved for a connection.

GSM Phase 2+ also defines (e.g. GSM 01.60, 02.60, 03.60, and 03.64) a packet form data transfer service, known as GPRS (General Packet Radio Service). In GPRS a radio resource is reserved dynamically, in which case the allocating to uplink and downlink transfer direction are made separately and independently of each other. A radio resource is only reserved when there is data to be transferred, and the radio resource to be allocated for each transfer direction is adapted according to the amount of data to be transferred in each data transfer direction.

In the solutions related to the third generation data transfer systems data transfer is suggested to be divided into traffic classes, based upon which connections can be handled in a way required by each need of data transfer. This means for example that in some connections it is possible to accept a bigger delay in order to ensure a better bit error rate, or correspondingly in some connection it is

possible to accept a higher bit error rate in order to minimize the delay. The properties for the bearer of a connection are typically negotiated during the establishing of a connection and they can also be modified according to the current situation. UMTS (Universal Mobile Telecommunication System) is a telecommunication system under development, which system is suitable for data transfer connected with several different data formats. The basis for the development of UMTS has no longer been the defining of different services but rather creating facilities for the implementing of various service models.

Table 1 (in next page) presents the current traffic classes used in the developing of UMTS. A traffic class acts as the primary definition for a connection and it can be made more accurate using parameters describing data transfer, such as highest allowable transfer delay, highest allowable bit error rate, highest allowable bit rate etc. The prime separating factor between the different UMTS traffic classes is delay-sensitiveness. The first class is suitable for very delay-sensitive data transfer (e.g. moving video picture, telephone traffic), and accordingly, retransmissions are not used and an acceptable bit error rate can already be achieved using channel coding methods. The second class is suitable for such data transfer which is not quite as delay-sensitive as the first class traffic, because of which the bit error rate can be improved using a simple retransmission method. Typical applications for the second class include streaming real-time applications, such as e.g. the transfer of video or audio data of retrieving type. The third and fourth class are best suited for such data transfer which is not particularly delay-sensitive, and accordingly better tolerates retransmission mechanisms improving the bit error rate. Such data transfer is typically connected with traditional Internet applications even in such a way that the third class is suitable for interactive, relatively irregular data transfer (e.g. using a www-browser (World Wide Web) and the fourth class for irregular background traffic (e.g. loading Email-messages).

Under such circumstances in which a signal to be transferred is subjected to plenty of interference, and data transfer over the radio interface becomes difficult, the number of data retransmissions correspondingly increases. In such data transfer in which requirements are set on both quality and delay, it is possible under difficult transfer conditions to end up in a situation, in which the retransmissions required for meeting the quality requirement reserve so large a share of the resource negotiated for the connection that meeting the quality requirement becomes impossible. Such a situation is possible for example in the above described UTMS second and third class data transfer.

TABLE 1

TRAFFIC CLASS	FIRST CLASS conversational RT - guaranteed capacity - no ARQ	SECOND CLASS streaming RT - quaranteed capacity - ARQ lite (MAC level ?) - Add. buffering in application	THIRD CLASS Interactive best effort - ARQ - interactive WWW, Telnet, - RT control channel	FOURTH CLASS Background best effort - ARQ background download of emails, calendar events, ...
TRDELAY	100ms, 200ms, 300ms	< 1 s	2 s	N / A
BER	$10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}$	$10^{-5}, 10^{-6}, 10^{-7}, 10^{-9(*)}$	$< 10^{-9}$	$< 10^{-9}$
MAX BIT RATE	MAX_{max} & MAX_{min} network returns MAX' $MAX_{min} < MAX' < MAX_{max}$	MAX_{max} & MAX_{min} network returns MAX' $MAX_{min} < MAX' < MAX_{max}$	N / A (**)	N / A (**)
USER PRIORITY	High, medium, low	High, medium, low	High, medium, low	High, medium, low

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Now a data transfer system and method have been invented, by using which the above presented disadvantages can be avoided. Said data transfer system is characterized in that the data transfer system comprises means for counting the number of retransmissions; means for comparing the number of retransmissions with a predetermined threshold value; and means, as a response to exceeding the threshold value, for initiating proceedings related to changing the properties of the bearer.

One of the objects of the invention is also a method for transferring information, the method comprising steps in which data units are transferred between a telecommunication network and mobile stations over radio interface; the received data units are checked; and data units found defect are retransmitted. The method is characterized in that in it the number of retransmissions is monitored; the number of retransmissions is compared with a predetermined threshold value; and, as a response to exceeding the threshold value, proceedings related to the changes of properties of the bearer are initiated.

One of the objects of the invention is also a mobile station communicating with a telecommunication network, and comprising means for receiving data units; means for transmitting data units; means for monitoring the retransmitting of defect data units. The mobile station is characterized in that it comprises means for monitoring the number of retransmissions; and means for transmitting the information related to the number of retransmissions to the access network.

The invention is based upon that in the telecommunication network element participating in the control of the retransmissions it has been arranged a counter or some other corresponding functionality, by using which the number of the executed retransmissions is monitored. A certain threshold value has been predetermined for the number of retransmissions, and when the threshold value is exceeded, the network element monitoring the count indicated by the counter is arranged to generate for the telecommunication network element handling the establishing and maintaining of a telecommunication connection a request to upgrade the radio resource negotiated for the connection.

The invention is explained in more detail with exemplary references to enclosed figures, of which in
Figure 1 a block diagram illustrates the network architecture presently used in the solutions in the UMTS -development;

Figure 2 illustrates the two first layers of the radio interface definition used in the UMTS -development;
Figure 3 illustrates an embodiment for implementing the functionality according to the invention;
Figure 4 illustrates another embodiment for implementing the functionality according to the invention;
Figure 5 shows the implementation of a counter according to the invention on the network level; and
Figure 6 shows the implementation of a counter according to the invention in the radio part of a mobile station.

The invention is explained in the following based upon the solutions presently used in UMTS developing without limiting the invention to the presented elements or the terminology used. The block diagram in Figure 1 illustrates the network architecture presently used in the solutions in the UMTS -development. MS is a user's portable terminal device (Mobile Station) connected over radio interface to access network UTRAN (UMTS Terrestrial Radio Access Network). Access network UTRAN is connected over an Iu-interface to one or more core networks CN. UTRAN comprises typically Radio Network Controllers (RNC) and Base Stations (BS), which radio network controllers RNC control the traffic received from the Iu-interface to mobile stations MS through base stations BS.

In the diagram in Figure 1 it has also been illustrated the hierarchy levels of the system, which levels have been divided into access specific hierarchy levels (Access Stratum, AS) and into independent hierarchy levels (non-Access Stratum, nAS). AS comprises access stratum layers belonging to access network UTRAN, and accordingly the AS -interface is the interface between the access network -dependent and independent layers. Alike the above mentioned one, the selected access network can provide a connection to several core networks CN of different types, also simultaneously, in which case the services characteristic of each backbone network, such as connection establishing signalling, mobility management and subscriber management, are outside the access specific hierarchy level and are thus transported transparently through the AS -hierarchy level.

The functionality controlling the establishing and maintaining of a data transfer connection is called Bearer Management (BM) and it compris s the proceedings required for enabling data transfer between two access points. One Bearer is

related to one connection, and typically several bearers can be connected to one physical channel. On the other hand, radio resource management is a functionality that is interactive with the bearer management and it comprises the operations for establishing the radio resource defined with the bearer management. In traditional second generation mobile communication networks BM has been the functionality of OSI Layer 3 –level and radio resource management has been the functionality of OSI Layer 2 -level, i.e. BM utilizes the services provided by radio resource management.

In the UMTS -hierarchy bearer management BM is located in Service Access Point, SAP separating said hierarchy levels. Bearer requests from core network CN are transported through service access point SAP as Call Control -messages, CC and are reflected as a number of messages of the Iu -interface. In the access network a bearer request is reflected as a group of Radio Resource Management, RRM -messages implemented over the air interface. The primary BM access point SAP is in core network CN, and in this embodiment BM control is from the point of view of the radio resource a RRM -functionality of access network UTRAN.

Figure 2 illustrates the two first layers of the UMTS -radio interface definition. Physical layer L1 provides a physical data transfer service for the higher layers. Transfer layer L2 is divided into two parts, of which MAC (Medium Access Control) provides for the higher layers the control functions required for utilizing the transfer services and it is located between entities MS and UTRAN, and LAC-U (Link access control) handles the connection between MS and CN. MAC control functions comprise

- service quality control by choosing a suitable channel type, by indicating the required transfer capacity and by providing a simple radio resource level retransmission service.
- transfer control by segmenting and assembling higher level data packets into lower level data packets suitable for the connection and vice versa.

LAC-U also comprises reliable retransmission services, using which the chosen error rate level can be ensured. LAC-U operates independently with regard to the radio interface. For each Bearer a separate LLC -entity (Logical Link Control) is established in LAC-U -layer, which

- provides a logical transfer connection for each bearer service,
- controls the order of data frames

- detects, and whenever possible, handles transfer-, format- and functional errors in the transfer connection
- handles flow control
- provides the service quality required by higher layers.

With regard to the functionalities and the proceedings related to retransmission service a reference is made to ETSI (European Telecommunications Standards Institute) Publications GSM 04.60 and 04.64.

In the present embodiment of the invention a new functionality has been added to the transfer layer functionalities prior known to a person skilled in the art, by using which the number of retransmissions is monitored at least with regard to delay-sensitive traffic classes. The number of retransmissions is given a threshold value, at the exceeding of which proceedings are initiated for rearranging the properties of the bearer. The comparing with the threshold value can be carried out in the transfer layer, and based upon it, a message to bearer management can be generated, the message comprising a request for the starting of a rearrangement. Correspondingly, the comparing can be a functionality of the bearer management, in which case the transfer layer transfers the number of retransmissions for comparing to be available for the bearer management.

The rearranging of the properties of the bearer is preferably implemented by negotiating for the bearer a larger radio resource in a prior known way. Correspondingly, it is also possible that the properties of the bearer are changed by modifying the quality- and delay requirements. Figure 3 illustrates an embodiment for implementing the functionality according to the invention.

According to the invention it has been arranged in the transfer layer counter i , which is reset at the beginning of the activity (Step. 31). A data unit from the transfer layer is received (Step. 32) and on it the transfer layer checking algorithms typical of the system are performed (Step. 33). If the checking (Step. 34) finds the unit to be valid, a jump to Step 32 takes place to receive the next data unit. If the unit is found to be ineligigle by the checking algorithm, then a normal data unit retransmission procedure is carried out (Step. 35). At each retransmission the value of the counter according to the invention is incremented by one step (Step. 36). The new value of the counter is compared with value Imax given for the maximum number of retransmissions (Step. 37), and if the value of the counter is lower than said maximum value, a jump back to Step. 32 for

receiving the next data unit takes place. If the value of the counter exceeds said maximum value Imax, a message concerning the rearranging the properties of the bearer is generated in the transfer layer to be transferred to bearer management BM (Step. 38).

Figure 3 presents in a simplified form the basic idea of the invention which can be defined more accurately without deviating from the original idea. If a long-term connection is concerned, just the number of retransmissions does not give a clear picture of the situation, but in order to obtain a more accurate control the information about the rate of retransmissions is needed. Figure 4 illustrates another embodiment for implementing the functionality according to the invention. In it timer T has been connected to counter i according to the invention, which timer is started always when a connection is started or when a message concerning the rearranging of the properties of the bearer has been transmitted. The momentary number of retransmissions is compared with predetermined threshold values m0, m1, ... The threshold value selector j used in the beginning of the activity is reset (Step. 400) in such a way that the first available threshold value m0 is used (Step. 402). At the same time timer T is started (Step. 404) and counter I according to the invention is reset (Step. 406). A data unit from the transfer layer is received (step 408) and on it the transfer layer checking algorithms typical of the system are performed (Step 410). If the unit is acceptable based upon the checking (Step. 412), a jump to Step 408 takes place to receive the next data unit. If the unit is found to be bad by the checking algorithm, then a normal data unit retransmission procedure is carried out (Step. 414). At each retransmission the value of the counter according to the invention is incremented by one step (Step. 416). Simultaneously time T is checked (Step. 418), counted by the timer from the start of the connection or from the preceding rearranging, and the momentary retransmission rate is determined as the quotient of counter I and time T (Step 420). The obtained value is compared with threshold value mj in use (Step 422), and if the determined value is lower than said threshold value, a jump back to Step 408 is carried out in order to receive the next data unit. If the value of the counter exceeds said threshold value mj, a message concerning the rearranging of the properties of the bearer, to be transferred to BM is generated in the transfer layer (Step 424). At transmission the message it is moved to use the next, typically higher threshold value by updating the counter by one step (Step. 426).

Access Stratus -layer is a data transfer layer, both ends of which comprise an ntity implementing the functionalities of the connection layer, the entities being

located in the network element accessed by the Access Stratus. It is to be noticed that in a system according to the invention the described functionalities of the transfer layer and bearer management can be physically arranged in any network element connected using the Access Stratus. As mentioned above, the transfer layer is typically a functionality of the UMTS AS -level, and accordingly the functionality of the transfer layer according to the invention has in the described embodiment of the UMTS system been placed in the network elements of MS and UTRAN. When implemented in this way, the functionality can be arranged symmetrically, in which case it is both on the MS side and on the network side, or the functionality can, specifically for an application, be arranged in only one of the elements.

The block diagram in Figure 5 describes in more detail the architecture and network elements of UMTS network, in which a counter according to the presented embodiment can be arranged. In addition to the earlier presented network elements the figure shows two different core networks CN1 and CN2, of which the first one C1 implements packet form data transfer according to IP access stratus and the second one C2 implements data transfer according to some circuit switched access stratus (e.g. GSM, PSTN, ISDN etc.). C1 is reflected to the Iu -interface through Packet Data Gateway, PDG, the backbone network and Packet Data Access Node, PDAN. C2 is reflected to the Iu -interface through Wideband MSC, WMSC. Both PDAN and WMSC utilize the information in a subscriber's home register HLR, and in addition to it, the circuit switched data transfer is controlled by Service Control Point, SCP. Counters C1, C2, C3 according to the first embodiment of the invention have in the figure been marked in elements MS, BS and RNC respectively. A counter can comprise any one of counters C1-C3 or any combination of them.

BM in UMTS system is in the SAP -access point between AS- and nAS -hierarchy levels, and thus its primary location in the UTMS system is presently in CN or i a control point alike SCP in Figure 5 in the Iu interface. Along with development the terms and the definitions of elements may change, but the basic idea of the invention is not dependent on the configuration of the system. For example, adding retransmission functions also in a higher level has been suggested, in which case the monitoring of retransmissions according to the invention could also be implemented on the side of core network CN.
Using the block diagram in Figure 6 it is possible to illustrate an embodiment of the invention, in which embodiment the number of retransmissions is monitored in

mobile station MS. The block diagram in Figure 6 shows the functionalities of the transmission and reception parts of a mobile station. The mobile station comprises for communication over radio path a radio unit, the unit comprising transmitter branch TX prior known from a conventional mobile station (the branch comprising the functional blocks performing channel coding, interleaving, encrypting, modulating and transmitting) 61, receiver branch RX (comprising the functional blocks performing reception, demodulation, de-encrypting and channel decoding) 62, for transmission over radio path duplex-filter 63 separating reception and transmission and antenna 64. The operation of the terminal device is controlled by main control unit MCU 65. The main control unit implements those functionalities according to the access stratus, which in the mobile station end handle retransmissions. In a mobile station according to the invention counter C1 66 is maintained in the main control unit, the value of which counter is incremented in connection with each retransmission. Said counter preferably comprises two separate blocks C1a and C1b, which monitor the number of retransmissions separately in uplink- and downlink -directions.

The above is a description of the realization of the invention and its embodiments utilizing examples. It is self evident to a person skilled in the art that the invention is not limited to the details of above embodiments and that the invention can be realized also in other embodiments without deviating from the characteristics of the invention. The presented embodiments should be regarded as illustrating, but not limiting. Thus the possibilities to realize and use the invention are limited only by the enclosed claims. Thus different embodiments of the invention, also equivalent embodiments, are included in the scope of the invention.

Claims

1. A data transfer system, comprising

means (MS, UTRAN, CN) for transferring data units over radio interface using a bearer;

means (MS, UTRAN, CN) for retransmitting data units found defect;

characterized in that the data transfer system comprises

means (C1, C2, C3) for counting the number of retransmissions;

means (C1, C2, C3; BM) for comparing the number of retransmissions with a predetermined threshold value; and

means (C1, C2, C3; BM), as a response to exceeding the threshold value, for initiating proceedings related to changing the properties of the bearer.

2. A data transfer system according to claim 1, comprising at least one core network (CN), an access network (UTRAN) connected to the core network and a number of mobile stations (MS) utilizing the services of the core network through the access network, the data transfer system comprising:

an access stratum (AS) facilitating the transfer of data units between the core network, the access network (UTRAN) and the mobile stations (MS), and comprises a functionality for retransmitting received packets containing errors;

characterized in that

said access stratum (AS) comprises means (C1, C2, C3) for detecting the number of retransmissions;

one of the following: an element implementing functionalities of a first connection layer (MS, UTRAN) and an element implementing functionalities of a second connection layer (CN), comprising means for comparing the number of retransmissions detected with a predetermined threshold value, and means for, as a response to exceeding the threshold value, initiating proceedings related to changing the properties of the bearer.

3. A system according to claim 2, **characterized** in that said means for comparing the number of retransmissions detected with a predetermined threshold value, and means for initiating proceedings related to changing the properties of the bearer as a response to exceeding the threshold value are included in the network element of the access network (UTRAN).

4. A system according to claim 3, **charact rized** in that said means for comparing the number of retransmissions detected with a predetermined threshold value, and means for initiating proceedings related to changing the properties of the bearer, as a response to exceeding the threshold value, are included in the radio network controller (RNC) of the access network (UTRAN).

5. A system according to claim 3, **characterized** in that said means for comparing the number of retransmissions detected with a predetermined threshold value, and means for initiating proceedings related to changing the properties of the bearer, as a response to exceeding the threshold value, are included in the base station (BS) of the access network (UTRAN).

6. A system according to claim 3, **characterized** in that said means for comparing the number of retransmissions detected with a predetermined threshold value, and means for initiating proceedings related to changing the properties of the bearer, as a response to exceeding the threshold value, are included in the mobile station (MS).

7. A system according to claim 3, **characterized** in that said change of the properties of the bearer is an increase of a radio resource.

8. A system according to claim 1, **characterized** in that said change of the properties of the bearer is the change of at least one of the following: quality requirement and delay requirement.

9. A method for transferring information, comprising steps

transferring data units between a telecommunication network and mobile stations using a bearer;

checking the received data units;

retransmitting data units found defect;

characterized by

monitoring the number of retransmissions;

comparing the number of retransmissions with a predetermined threshold value; and, as a response to exceeding the threshold value, initiating proceedings related to changing the properties of the bearer.

10. A mobile station communicating with a data transfer network (UTRAN), comprising

means (64, 63, 62) for receiving data units;

means (64, 63, 61) for transmitting data units;

means (65) monitoring the retransmission of defect data units;

characterized in that the mobile station comprises

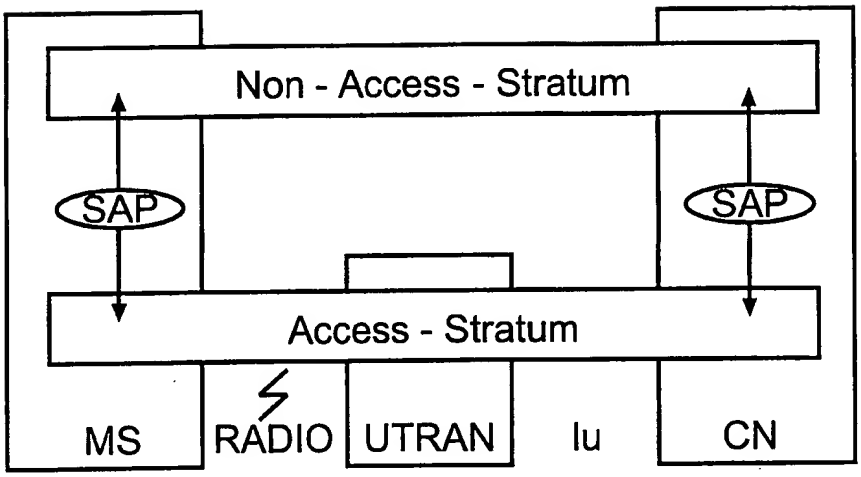
means (66) for monitoring the number of retransmissions; and

means (66, 65, 64, 63, 61) for transmitting information related to the number of retransmissions to the access network (UTRAN).

11. A mobile station according to claim 10, **characterized** in that the mobile station further comprises

means (65) for comparing the number of retransmissions with a predetermined threshold value; and

means (65) for initiating proceedings related to changing the properties of the bearer as a response to the exceeding of a threshold value.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SAP
SAP
Access - Stratum
MS
RADIO
UTRAN
Iu
CN

Figure 1

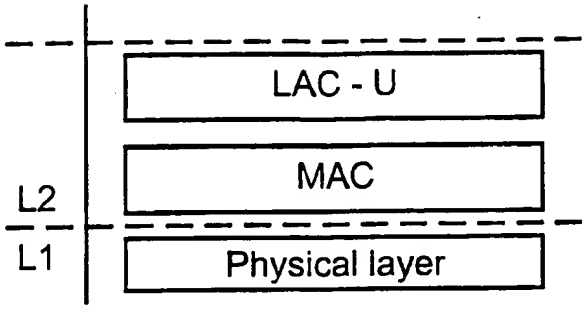


Figure 2

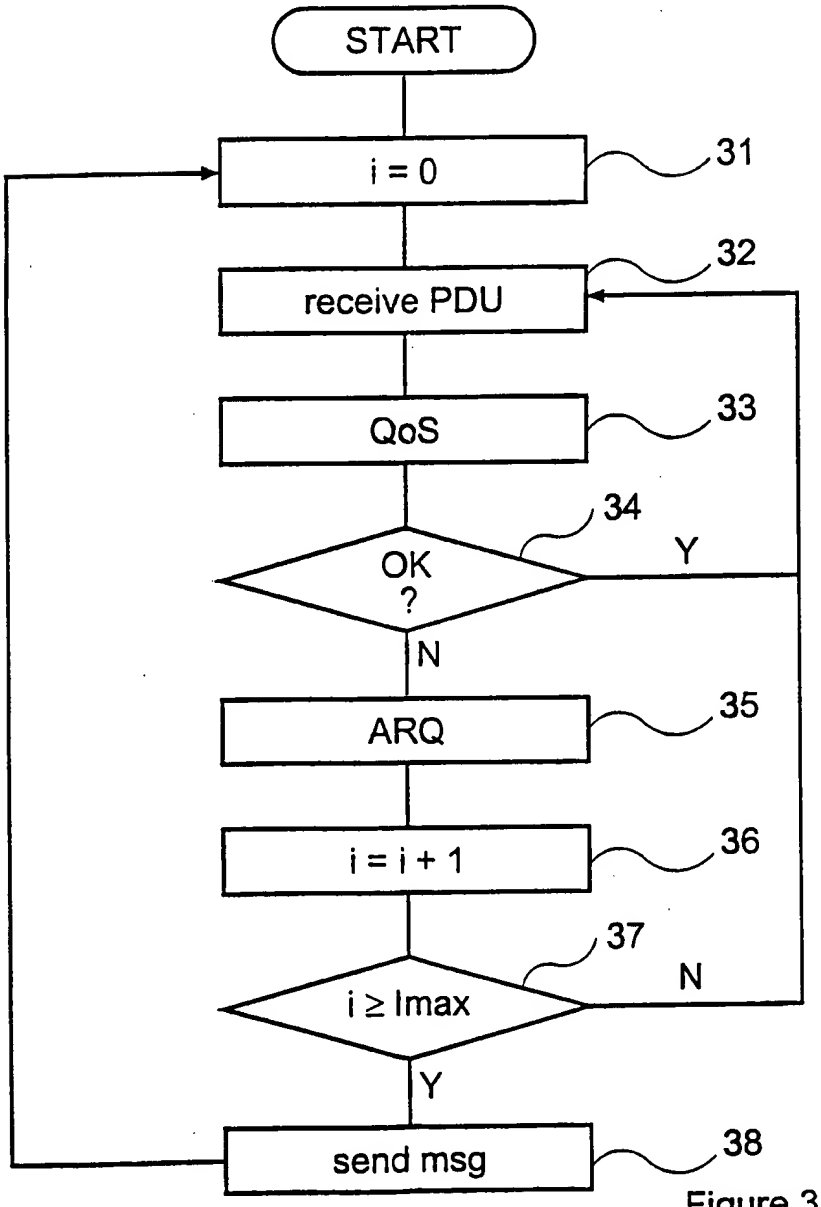
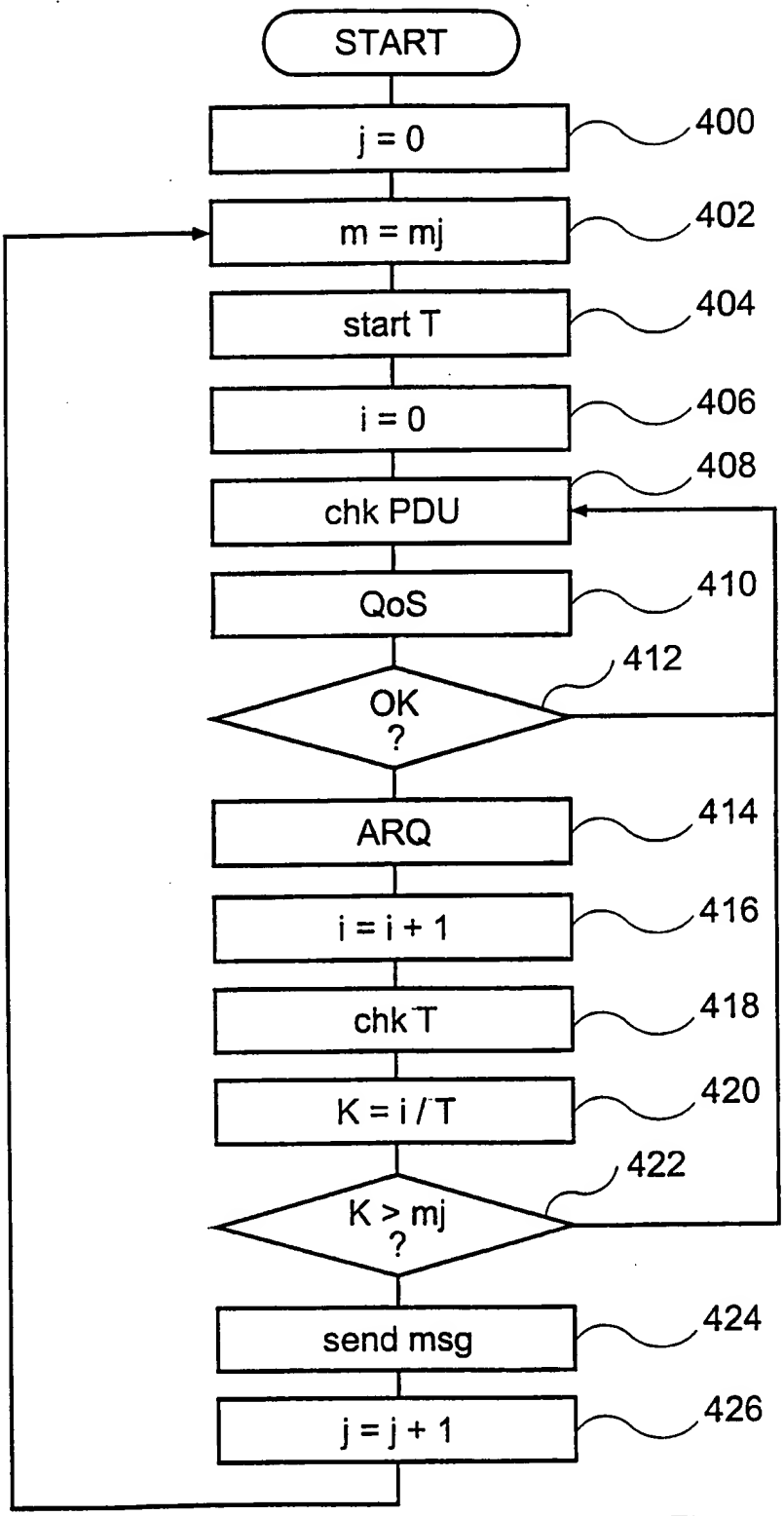


Figure 3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402
start T
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408
QoS
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OK ?
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ARQ
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i = i + 1
416
chk T
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K = i / T
420
K > mj ?
422
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424
j = j + 1
426

Figure 4

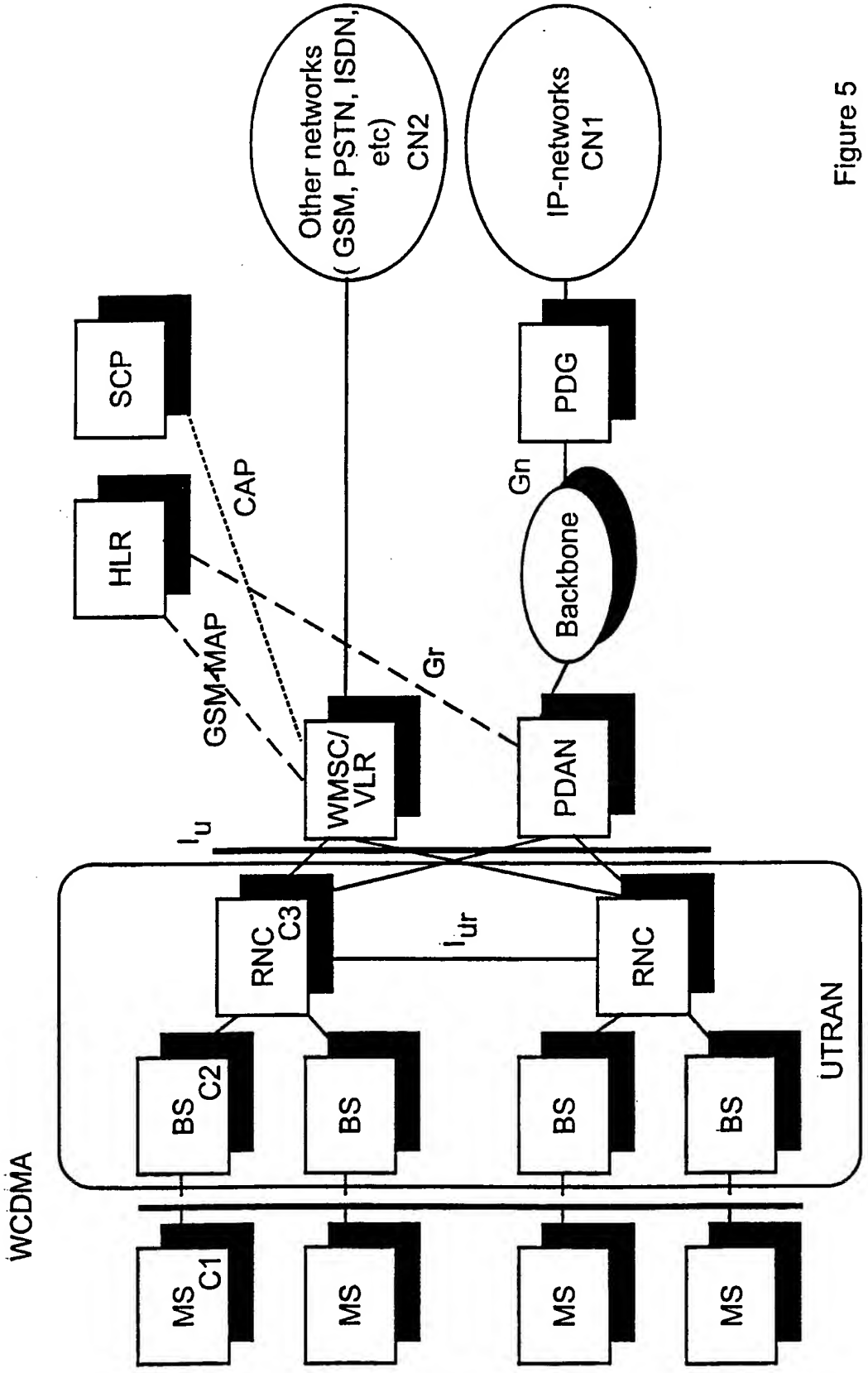
Other networks (GSM, PSTN, ISDN, etc) CN2
IP-networks CN1
SCP
HLR
CAP
GSM-MAP
Gr
PDG
Gn
Backbone
WMSC/ VLR
PDAN
Iu
RNC C3
Iur
RNC
BS C2
BS
BS
BS
MS C1
MS
MS
MS
WCDMA
UTRAN

Figure 5

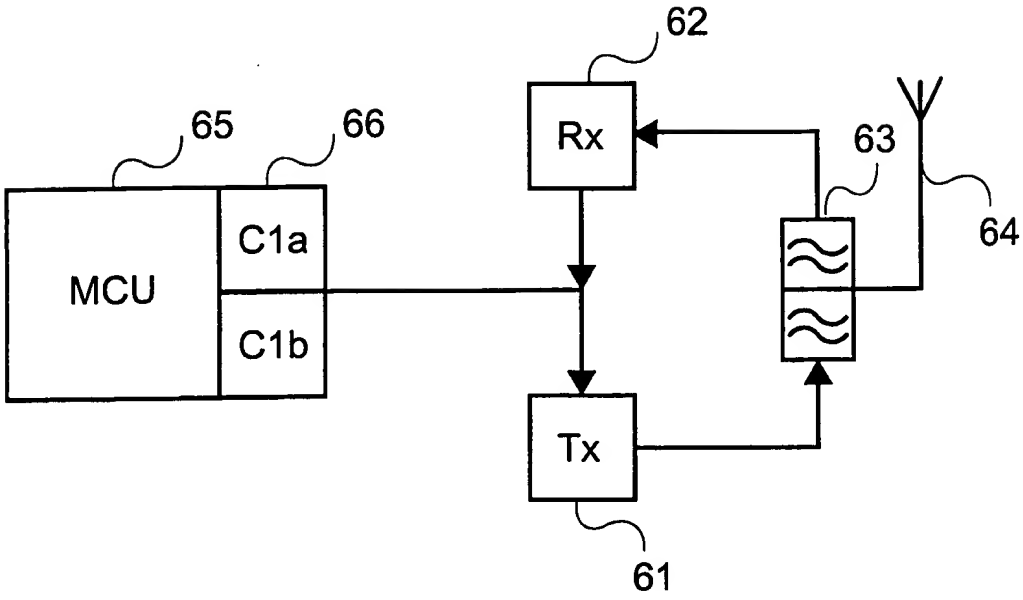

Figure 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00759

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, H04L 12/56
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9737507 A1 (ERICSSON INC), 9 October 1997 (09.10.97), page 1, line 1 - line 4; page 7, line 20 - line 32; page 8, line 1 - line 15, page 20, line 3 - line 16	1-11
A	US 4905234 A (J.S. CHILDRESS ET AL), 27 February 1990 (27.02.90), column 4, line 4 - line 18; column 18, line 15 - column 19, line 64	1,9,10
A	US 4697281 A (H.M. O'SULLIVAN), 29 Sept 1987 (29.09.87), column 2, line 13 - line 24; column 3, line 26 - line 32; column 8, line 54 - column 9, line 56	1-11

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2000	21 -02- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Per Källquist/MN Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00759

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9700568 A1 (INTERNATIONAL BUSINESS MACHINESCORPORATION), 3 January 1997 (03.01.97), page 1, line 29 - line 32; page 9, line 14 - line 17	1-11

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/FI 99/00759

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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